"Choose Parents Wisely"

Dairy Management Challenges To Genetic Improvement

DAIRY CATTLE BREEDING EXTENSION FOLDER 356 FEBRUARY 1978

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Genetic progress results from the wise choice of parents for each new generation of herd replacements. Calf losses, poor reproductive performance, and herd health problems will limit both the dairyman's selection choices and profit. These are key fitness traits that will affect the genetic progress by hampering selection of the best parents.

The dairyman can use management skills to reduce infertility, calf losses, and improve herd health. These traits cannot be improved very rapidly through genetic selection because they are not very heritable. Research has shown most genetic variation is due to special gene combinations that cannot be selected for in the same way most profit traits are improved — like milk yield. Herd management goals of low calf losses, good reproductive performance and a healthy herd must be achieved for genetic improvement of the herd.

Dairy herds, resulting from wise choices of AI sires and under good management, have shown genetic improvement rates of 125 to 150 pounds of milk per cow per year. With recent improvements in the quality of AI sires, dairymen have the opportunity to accelerate this rate of genetic change up to 230 pounds of milk per year — more than 12,000 pounds yearly in a 60-cow herd.

Genetic Progress Factors

Four major factors affecting genetic progress are:

Accuracy of selection — Wrong selection choices because of inaccurate evaluations will slow potential genetic progress. Selection decisions should be based on records and objective evaluations that remove non-genetic influences. Modern genetic tools for production traits such as *Predicted Difference* for sires, and *Cow Indexes* or *Estimated Transmitting Abilities* for cows provided in DHI records have been standardized to correct for non-genetic influences to help dairymen make accurate selection decisions. These tools have proven to be highly effective for predicting genetic results and should be routinely used to pick the best sires and cows.

Selection intensity — Choose only the best to be parents. Selection intensity is the margin of true genetic superiority of those selected in comparison to all those from which the choices were made. The margin will be greatest when the fewest animals are needed and chosen. Unfortunately, calf mortality, infertility and herd health problems force the dairyman to make less effective selection choices. Skillful management is essential to take advantage of the potential selection opportunity in a herd. A desirable goal is to cull the lowest 20% or more of the cows in the herd by choice each year. Most herds are able to cull only the lowest 10 to 15% of their cows each year because too many calves fail to enter the milking herd, and cows are involuntarily culled.

Generation interval — Generation interval is the average age of parents when their replacements are born. The rate of genetic progress depends on the frequency poorer animals can be replaced by better ones. A short generation interval will improve the opportunity to increase the herd's replacement rate. The opportunity for a genetically desirable replacement rate will be aided by raising all heifer calves born for herd replacements. These first calf heifers should freshen at 23 to 25 months of age, and managed for short calving intervals. The replacement rate will be slowed by breeding first-calf heifers to beef bulls, involuntary culling, calf losses and long-calving intervals. Four years of age is the minimum generation interval possible for a herd.

Genetic variation — Not all observable animal differences are genetic. Observed cow-to-cow differences that are genetic versus those influenced by the environment vary substantially among traits. The dairyman applies the genetic progress principles of genetic differences, or genetic variation.

Traits with high heritabilities can be improved more rapidly than those with low heritabilities (less than 10%). Slower rates of genetic change occur as heritabilities approach zero. Efforts to select for traits with little or no genetic variation, or low heritabilities, will yield no or poor results, and progress for other important heritable traits will be slowed.

Dairymen have little opportunity to influence genetic variation through management other than provide each animal the opportunity to express its full genetic potential.

Management Challenges

The dairyman's management skill has primary influence on selection intensity and generation interval. Any management deficiencies that increase the number of animals that *must* be culled (forced culling), or lengthen the time from one generation to the next, will retard genetic progress and profit potential. The herd's level of reproductive performance, calf losses, and health problems are the three major management concerns.

Reproductive Performance

Potential genetic progress is reduced by extended calving intervals, forced culling due to low fertility and sterility, and delayed entry of first calf heifers into the milking herd. Records show large herd-to-herd differences. For U.S. dairy herds the average calving interval is about 13 months. Fertility reasons account for 24 to 25% of the cows culled. An additional 5 to 12% of the virgin dairy heifers fail to reproduce. The typical average age of first-calf heifers entering the milking herd is about 27 to 29 months.

Table 1 shows reproductive performance levels that can be used to evaluate your herd's strengths, and the areas needing improvement. The "Good" levels are realistic and have been achieved by successful dairymen. Management adjustments are suggested when the herd average falls into the "Needs Improvement" category.

Dairymen without management skills necessary to achieve "Good" reproductive levels through the use of artificial breeding sacrifice both economically and genetically. Potential progress will also be lost if heifers are not bred artificially to superior sires. Studies have shown that the use of genetically superior AI sires results in genetic progress rates three to four times the rate of herds using natural service bulls. Through the use of multi-herd progeny tested sires, or intensely selected young sires, artificial breeding has essentially eliminated the risk of using sires of unknown genetic merit. Accurate heat detection and high conception with AI is profitable and genetically rewarding.

Extended calving intervals result in fewer calves born each year. The end result is fewer herd replacements and less cow culling which reduces the selection intensity.

Each month the calving interval is extended beyond 12 months results in an 8% reduction in the number of calves born in the herd each year. The effect of calving interval on the number of herd replacements is shown in Table 2.

Fewer herd replacements and less cow culling means keeping some less profitable cows each year that could have been culled. Each added herd replacement is an opportunity to cull an additional cow by choice and enhance the selection intensity.

The generation interval is also lengthened by extended calving intervals and delayed entry of first calf heifers into the milking herd. The difference between 12- and 14-month calving intervals and freshening first calf heifers at 24 as compared to 27 months of age is approximately 5 more months per generation.

Failure to use the offspring of first calf heifers as herd replacements will extend the herd average generation interval by approximately 4 months. Breeding dairy heifers to beef bulls also reduces the number of replacement heifers available each year by 30% or more. The result is a major loss to genetic progress.

The sex ratio, number of female to male calves born, cannot be controlled. It is consistently near 50:50 when large numbers of births are studied. It is not uncommon for a high proportion of either male or female calves to occur, particularly in small herds. While this stroke of luck or chance can have a drastic influence on the selection intensity in certain years, these lopsided ratios usually average out over time to approximately 50:50 in a herd.

Table 1 — Reproductive Performance Levels

	Good	Needs Improvement
Herd ave. calving interval (months)	12	13+
First estrus within 50 days post calving (% cows)	80%+ or more	70% or below
Percent estrus cycles normal 18 to 24 days (% cycles)	90%+ or more	70% or below
Calving to first breeding (ave. no. days)	45–70	85 or more
First service pregnancy (% cows)	62%+ or more	50% or less
Services per pregnancy (no. services)	1.65	2.0 or more
Percent cows pregnant, three or less services (% cows)	94%	85% or less
Age at which heifers reach puberty (months)	12	14
Age heifers are large enough to breed (months)	14–16	17 or more
Age at first calving for heifers (months)	23–25	26 or more

Table 2 — Effect of Calving Interval on Herd Replacements in 100-Cow Herd.

Calving interval	Ave. calves born per year	Bred heifers available for herd replacement per year*
12	100	38
13	92	35
14	84	32
15	76	29

**Assumes 75% of the female calves born survive to freshen as first calf heifers.*

Calf Losses

The number of female calves that enter the milking herd will affect both the opportunity to cull poor cows and the generation interval. Breeding and raising all females born to enter the milking herd as replacements will enhance genetic progress under intense sire selection. Selling unfreshened heifers or cows for dairy purposes for a short-run economic advantage offsets the herd's genetic progress.

High heifer survival from birth to freshening contributes to intense cow selection and a short generation interval, as well as providing direct economic advantage. Survival rates vary from 10 to 95% among herds, depending largely on management practices.

Table 3 — Typical Female Replacement Losses.

Time of loss	Range %
Calves born dead	5– 7%
Birth to six weeks	5–25%
Two to 24 months	0– 5%
Infertility of heifers	5–12%

Management plays a key role in keeping these losses small. Studies show that minimizing calf delivery

problems, diarrhea, and respiratory problems is particularly important. This includes providing proper assistance at time of calving, feeding fresh colostrum at birth, practicing good sanitation, and providing proper nutrition.

Infertility Among Heifers

It is not uncommon for up to 10% of the heifers to fail to breed and then never enter the milking herd. Free-martins, heifers with white heifer disease, and other structural or functional problems are included in this group.

Heifer rearing that results in either poor growth or obesity will increase infertility and the drop-out rate among heifers. Research shows underfed heifers usually do not reach sexual maturity in time to be bred and have their first calf by 25 months of age. Overfed or fat heifers frequently have conception problems. Animals overfed in early life also have poorer reproductive performance in both their first and later lactations and produce less lifetime milk. Proper feeding and management will aid for rapid growth, allowing heifers to begin showing their first heats by 12 to 13 months of age.

Calving Problems

Calves that experience a difficult delivery have a higher mortality rate than those born normally. Proper assistance at birth to prevent long delays in delivery will help minimize calf losses and be beneficial to the cow.

The incidence of difficult delivery is greatest among first-calf heifers. Studies have shown up to 18% of first-calf heifers need considerable assistance, as compared to only 3 to 8% of cows calving in their second or later lactations. The incidence of difficult births has been shown to be doubled when heifers are too small as compared to full-grown heifers. The sire of the calf being born can also be of some influence especially with first-calf heifers. Most bull studs evaluate their bulls for ease of calving. It is wise to avoid mating heifers to bulls that have a high incidence of difficult calvings.

Herd Health

Animal health problems cause forced early retirement of cows from the herd. This increases the rate of involuntary or forced culling and thus reduces the potential selection intensity. Each good cow culled involuntarily prevents the opportunity to cull an inferior cow voluntarily.

Infertility, mastitis, udder problems and other diseases and injuries strike good and poor cows in the herd with about equal frequency. Large herd-to-herd differences in the rate of involuntary culling and low heritabilities emphasize the importance of good herd management to keep the number of involuntary culls small.

Table 4 illustrates how the level of involuntary culling affects the voluntary culling opportunities at various rates of survival for heifer calves born to first freshening. The opportunity to cull poor cows voluntarily is usually determined by the number of replacement heifers and the number of cows that are lost or have to be culled involuntarily. This table illustrates that with high rates of involuntary culling (35%) and poor heifer survival (55%), a dairyman will experience a shortage of five replacements to meet the involuntary culling. With excellent management (heifer survival 95% and involuntary culling 15%) he has the opportunity to cull 37 of the 100-cow herd voluntarily.

The reasons why dairy cows leave herds as shown in Table 5 indicate which management areas are most important. Approximately 2 out of 3 cows leaving herds are culled involuntarily. The major involuntary losses are reproductive problems (26%) and mastitis and udder problems (23%).

Table 5 shows for typical herds that reducing infertility, mastitis, diseases, and problems causing udder or teat injuries can reduce these involuntary losses.

Table 4 — Voluntary Culling Rate Affected by Involuntary Culling and Heifer Survival to Freshening (100 cow herd).

Heifer survival rate (%)	No. heifer births*	No. heifers freshening	Involuntary culling rate (%)		
			15	25	35
			Voluntary culling rate		
95	55	52	37	27	17
75	55	41	26	16	6
55	55	30	15	5	-5

**A 100-cow herd typically has about 110 calves born yearly with 50% heifers. Added calves are due to both cows and their replacements having calves in the same year.*

Table 5 — Reasons for Cows Leaving Dairy Herds.

Reason	Percent
Voluntary Culling	
Low production	32.5%
Involuntary Culling	
Reproduction	26.6%
Mastitis	10.4%
Disease or inabilities	7.7%
Teat or udder injury	7.2%
Udder conformation	5.0%
Accidents and injury	4.0%
Type	3.1%
Disposition and milking ease	2.7%

Skilled management control of the environment and good cow care are essential. Modern herd health management emphasizes prevention through management and routine veterinary service, rather than using veterinary service only for emergencies. Successful herd health programs have reduced the need for emergency service and returned $3 to $4 for each dollar invested.

Health records are an essential part of these programs. Records are usually kept on an individual animal basis and provide a complete log of health-related events from birth to death. They are helpful to the herd manager, veterinarian, and AI technician in implementing the most effective practices for herd profits.

Health maintenance programs should include appropriate vaccinations, reproductive exams, mastitis control, and periodic review of the herd health status of the herd. Use of artificial breeding is the best preventative measure for several reproductive diseases.

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Cow Culling Strategy

Genetic progress will be most rapid when only accurately evaluated, genetically elite sires are used, every heifer calf is raised as a herd replacement, and few, if any, cows are culled involuntarily. Good cow-culling decisions require ongoing month-by-month evaluation and cow comparisons. It is recommended these decisions should be based on both the animal's present and anticipated future profit. The timing of removal also should be planned to minimize extended low-profit periods.

An added selection bonus with effective culling, combined with good reproductive performance (12- to 13-month calving interval) can be realized if cows leaving and replacements entering both contribute potential herd replacements in the same year. This selection bonus can intensify selection by increasing the herd's potential culling rate by 3 to 6% per year.

Additional Considerations

Harvest the Genetic Potential

Genetically superior cows must be fed and managed to achieve their genetic potentials. Failure to give herd members the opportunity to express their genetic capabilities will reduce the herd's profit potential. Feeding levels that greatly surpass the animal's genetic capabilities are usually inefficient and economically wasteful.

Provide Identification

Positive, permanent, and accurate animal identification is essential to good records and genetic progress. It brings money, time, and convenience in day-to-day herd management. A birth certificate containing sire, dam, birth date, and permanent animal identification for each calf takes little effort. The risk of mistaken identity will be smallest if done when each new calf is born.

Use Good Records

The risk of management error can be reduced with good records to monitor and evaluate results, to establish realistic goals, and to provide the specific information for scheduling and executing management action. Calving dates, milk production, health exams, heat dates, breeding dates, etc. are critical for deciding when and which ones to watch for heat, to pregnancy check, to cull, to dry, to prepare for calving, as well as how much to feed. Good records will help the dairyman exert tighter control over management inputs.

Production records are as fundamental to effective management as they are to genetic appraisal. The DHI (Dairy Herd Improvement) records available in each state can help in evaluating management strengths and weaknesses, scheduling management action, and signaling needed changes in management priorities.

Some important information provided by computerized DHI records include:

—Month by month accounting of individual cow production: accumulated lactation totals for comparing cows and for evaluating management factors affecting production results.

—Permanent identification records showing sire, dam, birth date for use in management and genetic evaluations.

—Important dates for cow management such as calving, dry, breeding, due, and birth.

—Feeding guidelines for individual cows based on individual needs, evaluations of the herd-feeding program and accounting of the feed fed.

—Production efficiency measures, such as pounds of milk per pound of grain, feed cost to produce 100 pounds of milk, income over feed cost, and value of milk produced.

—Lifetime individual cow records with complete and 305-day lactations, along with EPA (Estimated Producing Ability) and EATA (Estimated Average Transmitting Ability).

—Management action schedules of *Cows to Breed, Cows to Check Heat, Cows for Pregnancy Check, Cows to Dry,* and *Cows to Calve.*

—Cow rankings giving easy-to-use values for culling and selection, in addition to evaluations of sires used; herd turnover rate, herd age, etc.

—Herd summaries of the reproductive status, incidence of mastitis, days dry, and comparisons of groups of cows by age or feeding groups.

(**Note** — There are eleven DHI Computer Centers in the U.S. providing DHI records for dairymen. Management information provided by each center varies according to the needs and desires of dairymen served by the computing center. The above list is not complete, nor are all items available from each center.)

Summary

The major management challenges to genetic progress are good reproductive performance, low calf losses, and good herd health. Current and future profits will be greatest when these management challenges are achieved.

Infertility, calf losses and herd health problems reduce current profits because of lower production, higher herd health costs, and loss of animals. Future profits are limited because of slowed genetic progress from poorer opportunity to make wise choice of parents for each new generation. Keen management and animal care practices are the best way to minimize these losses.

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